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FloodSAFE

A Framework for Department of Water Resources Investments in Delta Integrated Flood Management

California Department of Water Resources

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Abbreviations and Acronyms

BDCP	Bay Delta Conservation Plan
CVFPB	Central Valley Flood Protection Board
CVFPP	Central Valley Flood Protection Plan
Delta Area	Sacramento-San Joaquin Delta plus Suisun Marsh
DFM	Division of Flood Management
DHCCP	Delta Habitat Conservation and Conveyance Program
DRMS	Delta Risk Management Strategy
DSC	Delta Stewardship Council
DSIWM	Division of Statewide Integrated Water Management
DWR	Department of Water Resources
EIP	Early Implementation Project
FEMA	Federal Emergency Management Agency
FESSRO	FloodSAFE Environmental Stewardship and Statewide Resources Office
FloodSAFE	California's FloodSAFE initiative for integrated flood management
FY	Fiscal Year
GIS	Geographic Information System
Legal Delta	Delta as defined in Water Code § 12220
LiDAR	Light Detection and Ranging
LMA	local maintaining agency
PL	Public Law
SB	Senate Bill
SPFC	State Plan of Flood Control
RD	Reclamation District

USACE	U.S. Army Corps of Engineers
HMP	Hazard Mitigation Plan
PL84-99	USACE Delta Specific guidelines for levee configuration

1 A Framework for Department of Water Resources Investments

1.1 Purpose

This document presents a framework to guide Department of Water Resources (DWR) investments between 2010 and 2030 to improve integrated flood management[1] in the Sacramento-San Joaquin Delta (Delta). This framework is intended to provide a clear context and rationale for discussing, evaluating and making difficult choices about how to invest limited DWR funds in integrated flood management related projects in the Delta. This framework was created to support decisions and investments that are likely to be made be made while a number of other large-scale planning efforts are underway that could significantly affect the Delta over the long-term. Also, this document is intended to support the Delta Stewardship Council (DSC) as it develops its *Delta Plan*.

1.2 Introduction

The Delta is a unique place defined by its ecological value as the transitional ecosystem from fresh to salt water and by its extensive network of levees. The levee network includes about 350 miles of project levees and 750 miles of non- project levees that function as a system. These levees are owned and maintained by a variety of entities within the Delta and responsibility for the proper function of these levees is distributed among State, federal and local agencies. These levees define a network of interconnected channels that border a collection of islands and tracts, with many of the protected land areas near or below sea level. Virtually all assets and attributes of the Delta depend upon this levee network.

The State of California has a significant interest in the benefits provided by Delta levees. Questions about how to manage the Delta resources in a sustainable manner are receiving a great deal of attention, and have for many years. As large scale planning efforts such as the Bay Delta Conservation Plan, the DSC's Delta Plan and the Central Valley Flood Protection Plan proceed, DWR intends to continue to use available funds and resources strategically to improve integrated flood management and help preserve the physical characteristics of the Delta "essentially in their present form" to the extent feasible.

Unfortunately, Delta levees are vulnerable to failure from many mechanisms. They can fail during high flood flows into the Delta, from high tides and waves, from earthquakes, and from undetected weaknesses (such as animal burrows). Furthermore, future changes such as sea level rise, potential increases in flood inflows to the Delta due to climate

[1] See glossary for definition of terms such as integrated flood management, project levees, non-project levees, island and tract.

change, land subsidence, and other stressors may increase the chance of levee failures. Since many of the lands protected are near or below sea level, when a levee fails and lands are flooded it can be very difficult and expensive to recover the lands after the flood. While this framework is designed to help DWR make strategic investments to help preserve the physical characteristics of the Delta, the framework also explicitly recognizes that large areas of the Delta could be irrevocably damaged during a large flood or seismic event.

Due to the characteristics of the Delta and a variety of factors, most of the lands within the Delta (especially within the primary zone) will continue to face a higher risk of flooding than areas within many floodplains upstream of the Delta. This is an important fact to consider when making land use decisions within the Delta.

For more information about the history of State involvement in Delta integrated flood management activities please see *Technical Memorandum: Delta Region Integrated Flood Management, Key Considerations and Statewide Implications* (DWR, 2011).

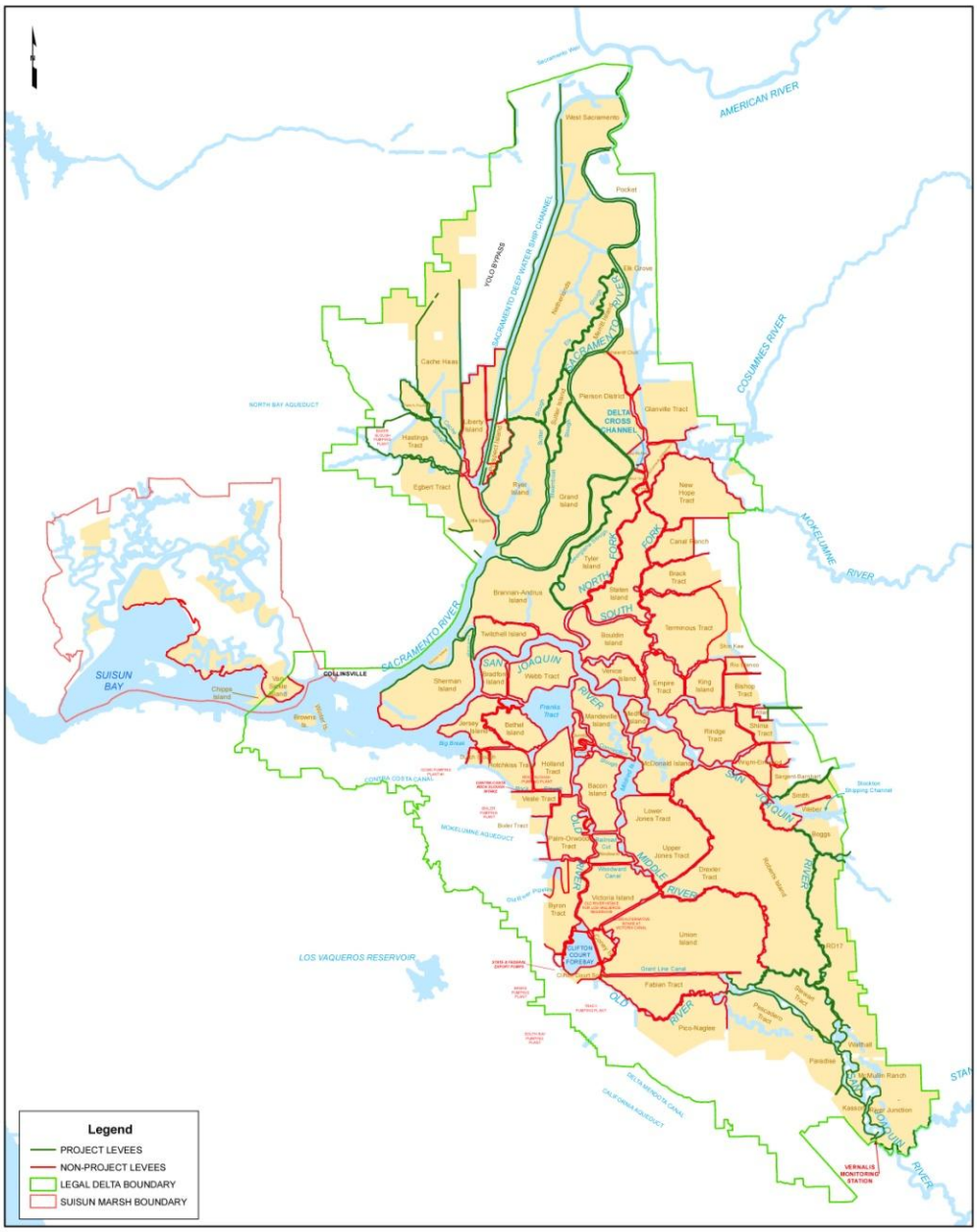
1.3 Scope and Context

This framework is meant to guide DWR's integrated flood management related decisions within the legal Delta[2] and the Suisun Marsh (see Figure 1-1). Most of the currently available DWR funding for these types of investments are being managed as part of DWR's FloodSAFE California Initiative[3]. The framework defined in this document is consistent with DWR's Strategic and FloodSAFE goals (see Appendix A) and the State's coequal goals of "providing a more reliable water supply for California and protecting, restoring, and enhancing the Delta ecosystem". Recognizing the central role that the Delta levees play in integrated flood management, water supply and ecosystem health, this framework supports fulfilling the legislative mandate that "The coequal goals shall be achieved in a manner that protects and enhances the unique cultural, recreational, natural resource, and agricultural values of the Delta as an evolving place" (Water Code § 85054).

[2] As defined in § 12220 of the California Water Code.

[3] FloodSAFE is a DWR initiative to improve public safety and flood management in California through a system-wide integrated approach that will help manage flood risk at regional and local levels. The comprehensive FloodSAFE vision is to create a more integrated, economically and environmentally sustainable flood management system that improves public safety for California.

Figure 1-1. Legal Delta and Suisun Marsh



1.4 Defining a Framework

As described above, deciding how to invest limited DWR funds to improve integrated flood management in the Delta can be quite complex. One way to enhance productive discussion and simplify the decision making process is to divide the overall decision into a number of smaller parts. If we can set DWR preferences for the various parts, the

decision-making process can be more systematic and easier. The framework was designed with the following questions in mind:

1. What are appropriate roles for DWR investment to improve integrated flood management in the Delta (i.e., what are the State's interests and expected benefits related to a potential investment)?

2. What can be done to provide State benefits (i.e., are their alternative ways to provide the desired benefits)?

3. What information can help make wise choices (i.e., are there ways to determine the value of an investment)?

4. What are some strategies or approaches that can support incremental investments to achieve commensurate benefits to areas of State interests?

1.4.1 State Interests Related to Integrated Flood Management in the Delta

One approach to answering the question about appropriate roles for DWR investment to improve integrated flood management in the Delta is to consider relevant defined State interests. The primary State interests related to integrated flood management in the Delta can be described as:

- Helping provide appropriate levels of flood protection. The State, through DWR and the Central Valley Flood Protection Board, has a long history of cost-sharing with the federal and local public agencies in flood management projects that provide benefits to local economies and our State and national economies. The State has a special responsibility related to facilities of the State Plan of Flood Control in the Sacramento-San Joaquin Valley, including project levees located in the Delta, and a declared interest in providing technical and financial assistance for Delta levee maintenance and rehabilitation.

- Providing a more reliable water supply for California. This interest involves water quantity, timing of deliveries, water quality, and conveyance to support urban and agricultural water users.

- Protecting, enhancing, and restoring the Delta ecosystem. In the context of integrated flood management projects, this primarily involves waterside channel-margin, tidal marsh, freshwater marsh, and floodplain habitats.

- Helping preserve the Delta as Place. This includes attempting to preserve cultural, recreational, natural resource and agricultural values of the Delta.

1.4.2 Types of Integrated Flood Management Work in the Delta

When answering the question about what can be done to provide State benefits, it is useful to be familiar with the types of work that can be done by various entities to improve integrated flood management and help preserve the physical characteristics of

the Delta. Given the intent and nature of the different types of work, DWR may participate in differing ways to help provide benefits for the areas of State interest.

- **Maintenance** - Maintenance includes activities to keep levees and other flood management facilities in good working order so they continue to provide an expected level of readiness for high water events. Maintenance is necessary to keep levee performance from deteriorating and may include major rehabilitation to address areas of weakness. Routine maintenance is periodic work necessary to keep the levee cross section and grade in conformance with its intended level of flood protection. In addition, repairs may be required when a levee is damaged or shows signs of distress (such as excessive erosion of levee embankments or boils) in ways that indicate an increase in the chance of catastrophic failure.

- **Facility Improvements** - Facility improvements include work intended to increase the level of flood protection provided by existing facilities (such as levees, gates, or overflow structures) to a protected area (such as an island or tract). Or, the improvement project may be designed to increase the safety factor for a target level of protection. This type of work typically does not alter existing levee alignments. Since levees in the Delta serve a variety of functions, they have been constructed (and may be improved) to differing standards. (See Appendix B –Levee Performance Standards.)

- **New Structural Solutions** – New structural solutions typically involve adding new facilities (e.g., levees, gates, floodwalls, etc.) or replacing existing facilities (e.g., setback levees).

- **New Non-structural Solutions** – New non-structural solutions typically involve actions designed to allow floodwater to spread beyond their current limits without causing damages. This may involve relocating structures and facilities out of the floodplain, establishing designated floodways, flood-proofing structures at risk of flooding, etc.

- **Habitat Enhancement** – The State has a goal and DWR has a legislated requirement to provide net habitat enhancement in the Delta. Integrated Flood management projects in the Delta may be designed to contribute to the net habitat enhancement goal. DWR intends to incorporate Delta habitat mitigation, restoration, and enhancement as integral components of flood management projects to the extent feasible. The ultimate goal is to improve environmental quality to the extent that Delta species thrive in sufficient quantities that periodic maintenance and repairs of flood protection facilities will not conflict with ecosystem restoration goals.

- **Emergency Preparedness, Response, and Recovery** - Emergency preparedness, response, and recovery include ways to identify and lessen the potential for, and consequences of, flooding by taking specific actions before, during, and after a flood.

- **Subsidence Reversal** - Subsidence control/reversal, coupled with carbon sequestration can be beneficial for Delta lands that are currently at or below sea level. Subsidence reversal projects may help address long-term levee stability problems associated with the effects of climate change.

- **Studies, Planning and Evaluations** – Planning and evaluations work typically are included in all projects including elements from the other listed types of flood management work in the Delta. Other potentially useful studies could include updating expected flood heights in the Delta, estimating sea level rise rates and potential effects, quantifying seismic risk, and others to provide information for improving ongoing maintenance and operation of the integrated flood management system in the Delta.

1.4.3 Determining the Value of DWR Investments

Information about project costs and benefits are an important input when making decisions about DWR investments. Unfortunately, understanding and describing the benefits that result from a particular integrated flood management project in the Delta can be very difficult. The challenges related to quantifying benefits of potential integrated flood management projects in the Delta arise because Delta levees serve a variety of purposes.

One obvious function of Delta levees is to contain flood flows, thus helping to prevent or reduce the chance of localized flooding of buildings, equipment, agricultural resources, and critical infrastructure (such as highways and railroads). Benefits provided by the levees associated with this purpose can be referred to as localized flood protection benefits. The US Army Corps of Engineers and others have developed well established procedures (such as quantifying the change in expected annual damages) to describe, evaluate and quantify benefits produced by localized flood protection projects.

Delta levees also play two important roles related to water supply. First, Delta levees support the channels that convey water supplies to the intended point of use (both within and outside the Delta). And second, the network of Delta levees supports efforts by reservoir operators to manage where the fresh and salt water transition occurs in the Delta. This is important in order to maintain an acceptable quality of water for in-Delta and export supplies. These types of water supply benefits stem from preserving the levee network and are not readily captured in traditional localized flood protection project benefit analyses. However, economic benefits related to investments that help preserve the levee network can be calculated using similar economic principles. If it is possible to estimate the expected reductions in the chance of failure for key portions of the network due to levee improvements, and to estimate the consequences of potential water supply outages or disruptions that would likely result if a portion of the levee network failed, then these changes in the chance of failure can be combined with the expected consequences of failure to estimate the economic benefit of the proposed investment.

Furthermore, the land and water areas associated with the network of levees and channels in the Delta provide important habitats and support many California native plants and

animals including threatened and endangered species. As such, investments in and around the network of Delta levees and channels can provide ecosystem benefits. Unlike the other types of benefits described above, differences of opinion exist within the economic community about the use of economic methods to quantify monetary value of ecosystem improvements. As a result, the DWR has most often used a non-monetary description of ecosystem benefits provided by a prospective project. Nonetheless, economic analysis, tempered by professional judgment, can still play an important role in decision making about projects that provide ecosystem benefit by using a least-cost alternative approach. This is typically done by assembling a variety of alternative projects that could provide similar ecosystem conservation benefits, and then comparing the cost of the various projects to identify the projects that provide the most value (benefit to cost).

Since many of the Delta levees perform multiple functions, a single project involving one or more Delta levees could provide benefits related to one or more of the following categories: localized flood protection, preserving the levee network, and ecosystem conservation. Understanding and quantifying all of these different types of benefits that could be produced by a potential integrated flood management project require differing analytical approaches.

Therefore, this framework uses three broad categories of benefit analysis to describe a recommended approach for making DWR investments in Delta integrated flood management. The categories of benefit analysis are "Localized Flood Protection", "Levee Network", and "Ecosystem Conservation".

1.5 A Recommended Approach

This recommended approach for making DWR investments in Delta integrated flood management attempts to synthesize the components outlined in the sections above in a logical manner that will lead to wise decisions about DWR investments that provide lasting value consistent with identified State interests. Of course, all program and project decisions are subject to available funds, requirements and limitations associated with how available funds can be used, professional judgment, and other legislated requirements.

1.5.1 Guiding Principles for DWR Investments in Delta Integrated Flood Management

Subject to available funding, DWR intends to consider the following principles when making investment decisions related to integrated flood management projects in the Delta Area:

- Encourage projects that provide benefits for multiple areas of State interest (as described in Section 1.4.1) and, where feasible, give preference to projects that address three or more areas of State interest.

- Where feasible, give preference to projects that help preserve opportunities for priority actions identified in other large-scale planning efforts, such as the Bay Delta Conservation Plan, the Central Valley Flood Protection Plan, and the Delta

Plan. DWR intends to coordinate with other related planning efforts before making decisions related to investments for major upgrades to Delta levees, new integrated flood management facilities, or extensive habitat enhancement.

- Where feasible, give preference to projects that provide the highest benefit, considering both economic or ecosystem benefits.

- Use existing programs and develop new programs that encourage the addition of project components which help protect, restore and enhance the natural environment through integration of related ecosystem functions and environmental stewardship with flood management projects in the Delta.

- Regularly determine and publish DWR priorities to guide currently available funding toward projects which the DWR believes provide the most value in areas of State interest (as described in Section 1.4.1).

- Leverage DWR investments by securing federal and local cost-sharing. Where needed, DWR may choose to fund 100 percent of some project costs to ensure that State interests are being addressed adequately.

- Generally in order to receive funding from DWR, quantifiable project benefits should exceed the State contribution, thus assuring that DWR's contribution yields a net benefit. Although ecosystem benefits of projects are typically not economically quantifiable, integrated flood management projects should be structured to achieve ecosystem benefits in the most economically efficient manner. Some programs may not require project-by-project economic justification.

1.5.2 Performance Targets and Funding Conditions by Benefit Analysis Category

While this section is organized around the three categories of benefit analysis presented in Section 1.4.3, many projects involving Delta levees may actually produce benefits in more than one of these categories. As a result, program designs and individual project funding decisions likely will need to consider all of these categories to fully appreciate the potential value of each investment.

- **Localized Flood Protection.** As funding is available, DWR intends to continue cost-sharing in projects designed to provide localized flood protection benefits. Typically, DWR programs designed to encourage and support these types of projects will rely on local public agencies to initiate and design the projects with technical assistance and financial support from DWR, and in some cases the US government. The rationale for encouraging local agencies to initiate and design these types of projects is based on the local agencies knowledge of the components of their localized flood protection system and their keen interest in providing an appropriate level of flood protection for their constituents. Examples of current FloodSAFE programs that can provide cost shares or

reimbursements for these types of projects include Delta Levees Subventions, Delta Special Flood Control Projects Program, Early Implementation Program (for project levees), Flood System Improvement Projects (for federally cost-shared flood management projects), and Flood Project Subventions.

Decisions about the appropriate level of DWR participation in localized flood protection projects will be made by DWR based, in part, on the land uses occurring in the protected area of the proposed project. Among the key land uses to be considered include: urban and urbanizing areas, small communities, agriculture, and critical infrastructure. Also, as mentioned before, DWR has a particular responsibility to maintain the facilities of the State Plan of Flood Control (including project levees within the Delta) according to the assurances provided through the Central Valley Flood Protection Board to the federal government.

- **Urban and Urbanizing Areas –** As funding is available, DWR intends to continue to provide technical and financial assistance to local public agencies to help provide the urban level of flood protection for urban and urbanizing areas[4]. Decisions about DWR participation in projects designed to improve Delta levees to FEMA accreditation, the urban level of flood protection, or seismic standards should be consistent with recommendations of existing programs (e.g., Central Valley Flood Protection Plan (CVFPP) or Early Implementation Program (EIP)). In order to avoid cost-sharing in projects that could lead to increased risk to life or economic damages in the Delta, DWR generally does not intend to participate in projects in urban or urbanizing areas that provide less than the urban level of flood protection unless that project is part of a credible plan to eventually provide the urban level of flood protection.

- **Small Communities –** As funding is available, DWR intends to provide technical and financial assistance to local agencies to help local public agencies from non-urban areas determine an appropriate level of flood protection and implement projects for small communities in ways that are consistent with relevant recommendations of the CVFPP. DWR may choose to cost-share in projects to provide FEMA accreditation for small communities, but generally only in situations where the proposed project limits the potential increase in assets at risk within the protected area by using ring levees or other facilities to limit growth-inducing impacts caused by levee construction.

- **Agriculture –** As funding is available, DWR intends to continue to provide technical and financial assistance to local public agencies in

[4] See glossary for definitions of urban area, urbanizing area, and urban level of flood protection.

agricultural areas for levee maintenance, repairs, restorations, and upgrades, as is economically feasible.

- **Critical Infrastructure –** As funding is available, DWR intends to continue to provide technical and financial assistance to local public agencies for levee maintenance or improvements that provide flood protection to critical infrastructure of statewide significance. Highways, aqueducts, transmission lines, and municipal pumping stations are examples of critical infrastructure of statewide significance. The appropriate level of flood protection will be considered for each potential project.

- **Levee Network.** As described above, the State has a significant interest in protecting the network of levees and channels that are key to preserving the uniqueness of the Delta. Many of the levees in the network are critical to preserving the current hydraulic function of the Delta, including conveying daily tidal flows, flood flows, and water supply for millions of Californians. Many Delta levees currently operate with an average water depth against the levees that is higher than the ground surface elevation of the interior island lands being protected – meaning some of these levees are under constant hydraulic load. As a result of these conditions, FEMA has made it a requirement that local public agencies improve all non-project levees in the Delta to at least the HMP standard (see Appendix B) in order for the local public agencies to remain eligible for federal disaster assistance should a flood disaster occur. Therefore, generally in order to receive DWR funding, any levee improvements for a given island or tract must be part of a plan to improve the entire length of levee for the island or tract to at least the HMP standard.

  Along with the U.S. Bureau of Reclamation, DWR has historically played a lead role in planning and constructing projects to improve Delta water quality and export water supply reliability. Levee and channel improvements associated with such projects may involve multiple levee districts, taking into consideration both the structural design requirements for levees critical to water conveyance, as well as the potential risks of cascading levee failures within the Delta levee network. DWR intends to fully consider the incremental economic benefits of investments in Delta levees beyond the HMP standard to address these risks of failure.

  - **Water Supply and Water Quality (for consumptive use) –** As funding is available, DWR intends to continue to evaluate which levees provide the most benefits to providing a reliable water supply (or conversely, identify levees that present the greatest threats for disruption of a reliable water supply).

    To the extent feasible, all DWR investments for this purpose will be prioritized to address the most severe threats first.

- **Delta as a Place –** As funding is available, DWR intends to cooperate with local public agencies to develop local plans to improve levees within the Delta levee network to at least the HMP standard. Some levees may warrant additional investment to provide a level of protection beyond the HMP standard, but these projects likely would need to be justified based on one of the other categories of benefit described in this section.

  To the extent feasible, all DWR investments for this purpose will be prioritized to address the most severe threats first.

- **Ecosystem Conservation.** As funding is available, DWR intends to design programs that encourage development and funding of integrated flood management projects in the Delta that incorporate features to enhance the ecosystem function of the river system and enhance the quantity, quality, and/or connectivity of associated habitat areas while improving integrated flood management. Generally, this will include early and frequent planning and collaboration among DWR and regulating agencies along with others making strategic investments to improve the ecosystem landscapes within the Delta. To the extent feasible, DWR intends to focus funding to achieve enhancements that benefit ecosystem functions and create a healthier Delta environment for all native species. Given its critical importance to the survival of sensitive aquatic species, DWR will seek to protect and enhance waterside channel-margin habitat wherever feasible as part of its integrated flood management projects.

  - **Channel-Margin Habitat along River Corridors –** The channel margins along levees that line major river corridors (such as Sacramento, San Joaquin, Mokelumne), are critical habitat, especially for out-migrating juvenile salmonids. Where appropriate, DWR intends to incorporate levee habitat for fish and riparian species (e.g., migratory birds) into levee improvement project designs. Such habitat may also serve to provide erosion control for the levee structure.

  - **Floodplain and Wetland Habitat-**Current scientific evidence points to the need for additional flood plain and tidal wetland habitats to provide opportunities for threatened and endangered (T&E) species recovery. Therefore, DWR intends to actively promote design features that incorporate these types of habitats and that will aid recovery of T&E listed species, where appropriate. DWR intends to implement and support developing the integrated flood management system in a manner that will contribute to the enhancement and restoration of critical habitat for T&E species and staff intends to coordinate with other State and federal efforts to aid in species recovery.

  - **Deliver Net Habitat Enhancement –** Across all of its programs, DWR intends to go beyond the mere avoidance of habitat impacts and mitigation to encourage and implement flood and water management

projects that result in significant net habitat enhancement on a Delta-wide basis.

1.5.3 DWR Cost Sharing

Typically, DWR investments in integrated flood management projects require federal and local cost-sharing that vary by type of project. This approach of cost sharing is founded on the principle that local entities in the Delta and elsewhere remain responsible for their levees and committed to keeping their levees in good condition. However, local interests in levee maintenance may not always match State interests and priorities. Therefore, in some cases incentives to promote projects that go beyond local interests may be required. Also considerations of local ability to pay may also influence State requirements for local cost-sharing rates.

The California Legislature has instructed DWR to make "all feasible efforts to obtain funding from the federal government in advance or by arranging to perform work that is a federal responsibility prior to the availability of federal appropriations with the intention that the costs will be reimbursed or eligible for credit by the federal government" (See Proposition 1E passed in 2006 and Budget Act of 2008). As funding is available, DWR intends to work with local public agencies to facilitate their participation in federal projects of interest to the State. When appropriate and feasible, DWR intends to engage the federal government directly as an active partner in Delta integrated flood management project evaluation and implementation. In addition, local partners generally are expected to provide cost-sharing for projects that enhance local flood protection or provide other local benefits.

The following describes State cost-share approaches for qualifying integrated flood management projects:

- **Federally Authorized Projects** - California Water Code § 12585.7 identifies the State cost-share of non-federal capital costs for federal flood management projects. Since 2001, DWR pays 50% of the non-federal cost-share for approved projects, but may pay up to 20% more, for a total of 70% of the non-federal cost-share, if the project makes significant contributions to one or more of the following:

    - Open space
    - Recreational opportunities
    - Flood control for disadvantaged communities
    - Flood control for State transportation or water supply facilities

    Therefore, local agencies that would otherwise pay 50% of the non-federal cost-share may have their contribution reduced to 30% of the non-federal cost-share if their project makes significant contributions to one or more of the above objectives. For more specifics about this cost-share approach, see DWR's Guidelines for Establishing Local Agency Cost-Sharing Formulas for Flood Programs and Projects (DWR, 2010) adopted to comply with AB 5, Sec. 26, Cal.

Water Code § 9625. Where significant ecosystem benefits result from a project, DWR may elect to increase the State share further.

- **Non-federal Projects** – The California Water Code identifies the State cost-share for work on eligible project[5] and non-project levees in the Delta:

    - Water Code §12980-12995 provide for State cost share of costs incurred in any year for the maintenance or improvement of project or non-project levees. The State cost-share shall be not more than 75 percent of any costs incurred in excess of one thousand dollars ($1,000) per mile of eligible project or non-project levee.

    - Water Code §12310-12318 and § 12300 and 12311 provide for special projects that provide for public benefits. The codes set no limit for State cost-sharing. Current Special Projects guidelines start at 50% and go up; however, DWR has traditionally provided State cost-sharing in the 75% to 95% range with occasional projects funded 100%.

Local agencies receiving DWR funds will be required to indemnify and hold and save DWR, any other agency or department of the State, and their employees free from any and all liability for damages, except those caused by gross negligence, that may arise out of the construction, operation, or maintenance for any project prior to receiving any State cost-sharing.

1.6 Preliminary Investment Priorities

Beyond the proposed approach described above, another important and difficult aspect related to making wise DWR investments is how to allocate limited funds among different categories of State interest. In an attempt to help promote open and transparent dialog about these choices, DWR has prepared a summary of preliminary priorities it can use to guide its budget recommendations and work planning (Table 1-1).

These priority designations are meant to guide long-term budget and funding allocation strategies, and are not prescriptive. For instance, projects that fall within the second and third priority categories may receive funds in a year when some projects in the first priority category may not be fully funded.

[5] Within the Delta primary zone, project levees are currently eligible to receive local assistance funding from the Delta Levee Subventions Program as long as more than 50 percent of the island is protected by non-project levees. In the secondary zone, project levees are not eligible for Subventions.

Table 1-1 Preliminary Recommendations for DWR Investment Priorities

Priority for DWR Investment in Delta Integrated Flood Management	Categories of Benefit Analysis		
	Localized Flood Protection	**Levee Network**	**Ecosystem Conservation**
First	Protect Urban Areas	Protect Water Quality and Water Supply Conveyance in the Delta	Protect Existing and Provide for Net Increase in Channel-margin Habitat
Second	Protect Small Communities and Critical Infrastructure (Located Outside of Urban Areas)	Protect Flood Water Conveyance in and through the Delta	Protect Existing and Provide for Net Enhancement of floodplain habitat
Third	Protect Agriculture and Local Working Landscapes	Protect Cultural, Historic, Aesthetic, and Recreational Resources (Delta as Place)	Protect Existing and Provide for Net Enhancement of Wetlands

2 Glossary

Appropriate level	The term "appropriate level of flood protection" used in this document means the level of flood protection that is considered by DWR to be justified based on costs, monetary benefits, and intangible benefits and impacts.
Channel-margin habitat	Habitat restoration along the water side of levees would be restored to a more natural state. This could be accomplished by increasing instream woody material (e.g., logs), restoring riparian vegetation to provide overhanging shade (trees and bushes), and constructing shallow benches that periodically are exposed to discourage predators.
Delta as place	In the Delta Vision Strategic Plan (2008), the Governor's Delta Vision Blue Ribbon Task Force recognized that Delta levees support many State interests, and that the Delta itself was of value "as a place" due to its cultural, historical, and aesthetic values.
Island	Delta islands are areas completely surrounded by levees. Since Delta island areas are generally below sea level, these levees hold back water every day of the year.
Legal Delta	The legal Delta consists of approximately 738,239 acres at the confluence of the Sacramento and San Joaquin Rivers as defined in § 12220 of the California Water Code.
Non-Project Levee	For the Delta, non-project levees are levees that are maintained by reclamation districts or levee districts, but are not part of the SPFC. Non-project levees in the Delta include only those shown on page 38 of DWR's Sacramento-San Joaquin Delta Atlas, dated 1993.
Project levee	Project levees are those levees that are part of the State-federal flood protection system in the Sacramento-San Joaquin Valley of California. These are levees of federally authorized projects for which the State has

	provided assurances of cooperation to the United States federal government and are considered part of the State Plan of Flood Control (SPFC); see State Plan of Flood Control Descriptive Document (DWR, November 2010).
Tract	Delta tracts are areas around the edges of the Delta that are subject to tidal influence, but do not require levees on all sides because of the presence of high ground on one side. However, some tracts have levees on the high ground portion to protect the areas from upstream runoff. Also, some islands are named as tracts – Webb Tract for example.
Urban Area	A developed area in which there are 10,000 residents or more (Government Code § 65007 (i))
Urbanizing Area	A developed area or an area outside a developed area that is planned or anticipated to have 10,000 residents or more within the next 10 years (Government Code § 65007 (j))
Urban Level of Flood Protection	The level of protection that is necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by, the Department of Water Resources (Government Code § 65007 (k))
Water resources	As used by DWR in its mission statement, the term "water resources" has a broad meaning that includes all aspects of California's waters – surface water, groundwater, droughts, floods, water quality, water uses and a wide array of strategies for management of water resources.

Appendix A – DWR Mission and Goals

The mission of DWR is:

> *"To manage the water resources of California in collaboration with others to benefit the State's people, and to protect, restore, and enhance the natural and human environments."*

As used by DWR in its mission statement, the term "water resources" has a broad meaning that includes all aspects of California's waters – surface water, groundwater, droughts, floods, water quality, water uses and a wide array of strategies for water resources management.

DWR Goals

DWR's Strategic Business Plan (DWR, 2005) expands on the DWR mission by defining eight strategic planning goals:

1. Develop and assess strategies for managing the State's water resources, including development of the California Water Plan Update.

2. Plan, design, construct, operate, and maintain the State Water Project to achieve maximum flexibility, safety, and reliability.

3. Protect and improve the water resources and dependent ecosystems of statewide significance, including the Sacramento-San Joaquin Bay-Delta Estuary.

4. Protect lives and infrastructure as they relate to dams, floods, droughts, watersheds impacted by fire and disasters, and assist in other emergencies.

5. Provide policy direction and legislative guidance on water and energy issues and educate the public on the importance, hazards, and efficient use of water.

6. Support local planning and integrated regional water management through technical and financial assistance.

7. Perform efficiently all statutory, legal, and fiduciary responsibilities regarding management of State long-term power contracts and servicing of power revenue bonds.

8. Provide professional, cost-effective, and timely services in support of DWR's programs, consistent with governmental regulatory and policy requirements.

FloodSAFE Goals

1. **Reduce the Chance of Flooding** – Manage flood events to reduce the occurrence of floods that could damage California communities, homes and property, and critical public infrastructure.

2. **Reduce the Consequences of Flooding** – Take actions that will reduce the adverse consequences of floods when they do occur and allow for quicker recovery after flooding.

3. **Sustain Economic Growth** –Design the sustainable integrated flood management system to facilitate continuing opportunities for prudent economic development that supports robust regional and statewide economies without creating additional flood risk.

4. **Protect and Enhance Ecosystems** – Improve integrated flood management systems in ways that include habitat functions as a facility design parameter. Incorporate, protect, restore, and enhance ecosystems and integrate flood management with other public trust resources needs.

5. **Promote Sustainability** – Plan for social, economic and environmental sustainability in structuring flood systems for improving public benefits and protection. Take actions that improve compatibility of the integrated flood management system with the natural environment and reduce the expected costs to improve, operate, and maintain the integrated flood management systems into the future, including ecosystem function and future flood management system expandability in the design.

Appendix B - Levee Performance Standards

Some of the possible levee standards that could be used in the Delta are listed in the order of increasing level of protection:

- **HMP** – The HMP standard provides for a minimum crest width of 16 feet, waterside slope of 1.5 horizontal on 1 vertical, landside slope of 2 horizontal on 1 vertical, and only 1 foot of freeboard above the water level with 1 percent annual chance occurrence (100-year water surface defined by the Corps in 1986). It is important to recognize that 1 foot of freeboard at a 100-year flood does not mean 100-year flood protection as common levee design practice calls for 3 feet of freeboard at project design flood. Also, the uncertainties of Delta levee foundations and unpredictability of Delta tide levels suggest that even with 3 feet of freeboard, the degree of flood protection would be less than the design flood frequency.[6] When the HMP standard was established, it was considered the minimum for levee cross section on an interim basis until higher long-term levels of improvement could be implemented. HMP provides for a levee cross section factor of safety against sliding of about 1.0, far lower than conventional levee standards. Considering that many Delta levees hold back water year round much like a dam, the HMP standard is still regarded by DWR engineers as providing only the basic temporary level of flood protection that is required for federal disaster assistance eligibility. The HMP standard only establishes a requirement for a levee cross section based on the material properties of the typical materials used to construct the non-project levees in the Delta. HMP does not include additional requirements related to site-specific geotechnical analyses or checks for vulnerability from under seepage, through seepage, or earthquakes.

- **Delta Specific PL 84-99** – The PL 84-99 guidance provides for somewhat better flood protection than the HMP standard. The PL 84-99 guidance flattens the side slopes (3:1 to 5:1 landside and 2:1 waterside) from those used for the HMP standard and increases freeboard above the 1 percent annual chance water level to 1.5 feet. This Delta Specific PL 84-99 cross section was determined by USACE to have a minimum factor of safety of 1.25. However, the freeboard of 1.5 feet above the 1 percent annual chance water level is still less than that required for FEMA accreditation. The PL 84-99 guidelines were recommended by CALFED as the base level of protection for Delta levees. The federal Water Resources Development Act (WRDA) of 2007 authorizes the Secretary of the Army to undertake the construction and implementation of levee stability programs or projects in the Bay Delta for such purposes as flood control, ecosystem restoration, water supply, water conveyance, and water quality objectives as

[6] Reference: Hazard Mitigation Plan, dated September 15, 1983, page 13.

outlined in the CALFED Bay-Delta Program Programmatic Record of Decision (August 2000 ROD) and contains specific direction concerning justification of projects and programs.

- **Bulletin 192-82** – The Bulletin 192-82 cross section recommendations produces a levee that is similar to one built according to the PL 84-99 guidelines except that the design water level has a 0.33 percent (1 in 300) annual chance of occurrence. Freeboard for levees protecting rural areas is 1.5 feet and freeboard for levees protecting urban areas is 3 feet. For much of the Delta, there is little difference (few inches) between the 1.0 percent (1 in 100) and the 0.33 percent annual chance of occurrence water levels.

- **Rural Project Levees** – These levees generally provide 3 feet of freeboard above the design water surface (1957 profiles from USACE in the Sacramento River basin and 1955 profiles for the San Joaquin River basin) and 6 feet of freeboard above the design water surface for bypasses. The design water surface levels are generally for floods smaller than the 1 percent annual chance of occurrence. These levees generally do not meet FEMA accreditation standards.

- **FEMA Accreditation -** These levees provide 3 feet of freeboard above water level of 1 percent annual chance of occurrence. These levees include geotechnical designs to control through-seepage and under-seepage.

- **Urban Levees** – These levees protect against an event with an average 0.5 percent chance of annual occurrence, with a minimum of 3 feet of freeboard. Specific standards are provided in the *Interim Levee Design Criteria for Urban and Urbanizing Areas in the Sacramento-San Joaquin Valley Version 4* (DWR, December 2010).

- **Seismic Levees** – In addition to considering the hydraulic loading, and depending on the assets to protect, some of the Delta levees could be designed to resist dynamic loading from credible earthquake forces generated by faults located in the vicinity of the Delta.